Submarine Target for a Nuclear Test
And
Life Aboard A Diesel submarine In the 1950s

The purpose of this paper is to recount one submarine's participation in Operation Hardtack, a nuclear weapons test conducted in the spring of 1958. In so doing, in order to get the context and ambience surrounding the test, I will relate some facts about submarining, and what it was like to be aboard a diesel submarine in the 1950s. I will talk about Operation Hardtack because it became the crown on the otherwise tarnished reputation of a submarine that existed for less than seven years.

First, here is a little background on the submarine itself. USS BONITA (SSK 3) was built at Mare Island Naval Shipyard in California. It was designed after World War II to be a small, inexpensive hunter killer platform, that is a submarine designed to sink enemy submarines. The keel was laid in March 1950; BONITA was launched in June 1951 and commissioned in February 1952. BONITA was one of three submarines of its class. When it was commissioned and for the first few years of its life it was known as USS K 3 (SSK 3), it was changed in December 1955 to USS BONITA (SSK 3). The other two submarines in the class were BARRACUDA (SSK 1) and BASS (SSK 2). BARRACUDA was home ported at the Submarine Base New London, BASS and BONITA at Submarine Base Pearl Harbor, Hawaii. BONITA had a rather bulbous bow, which contained the obsolescent passive BQR-4 sonar that was highly effective at slow speeds, but its bearing accuracy was poor. The class was designed for a newer passive sonar with higher bearing accuracy, the BQR-2, which was contained on a chin mount under the bow. But, as a cost savings, that sonar was never installed. Instead the World War II JT sonar, a *T* shaped device on the forward deck, was added to give bearing accuracy, but it had very limited range. Atop the bow was a piece of active *searchlight* sonar. It was used for taking a single ping range just before firing a torpedo. Its range was also very limited.

Let me tell you a little more about the submarine itself. I think it will help you understand why it was picked to be a target for a nuclear test.

Some of the good features of the class were its simplicity in several areas. It had a dry snorkel mast, no main induction valve, half a fleet boat battery split forward and aft, no conning tower and therefore no safety tank, no low pressure blower for the ballast tanks, instead a diesel exhaust gas blow system similar to what the German submarine force had used during World War II, a simple remotely operated electrical control panel which kept the battery always available for propulsion, the newest fire control system, four torpedo tubes forward but none aft, all AC power rather than split between AC and DC.

Some of the bad features of the class were the propulsion diesels, the seawater to fresh water distilling plants, and the DC to AC motor generators. First the diesels: they were known as *dinkies.* World War II Fleet Boats each had one of them. Made by the Cleveland Diesel Division of General Motors or Fairbanks Morse, they were designed to keep a zero float on the battery while speeding along, *full on four*, on the main propulsion diesels. After the war most submarines kept in commission had them taken off because they were hard to maintain, fairly inaccessible, and only marginally reliable. On the K class they were a pain to maintain. Using the engine exhaust to blow ballast tanks instead of a low pressure blower was especially hard on them. They leaked cooling water and lube oil; rarely were all three in commission. On one occasion at sea all three engines were broken. The enginemen swore at them but could usually get them back running again in a few hours of backbreaking work. Added to all of these problems the engines, for sound quieting purposes, were completely isolated from anything directly mounted on the hull. The sound couplings used were made of hard rubber, as a result causing the whole mass to vibrate like a tuning fork. Copper or steel fuel and lube oil pipes were constantly breaking, spewing oil, causing the engine to shut down usually with a fire breaking out. We could count on one such occurrence every day, sometimes once a watch.

Next, the distilling plants were not only unreliable but even when on the line did not make enough water to keep a crew happy. When BASS was being transferred from Pearl to San Diego, the Submarine Force Commander in the Pacific, commonly referred to as COMSUBPAC, had to scramble a Submarine Rescue Vessel to go out and provide

water lest BASS begin to drift for lack of water to her diesels. Often which short of water the crew resorted to drinking and brushing their teeth with canned orange juice.

Finally, the DC to AC motor generators, affectionately known as 75 KVAs, were also unreliable and nearly impossible to parallel. There were two, they were supposed to be shifted daily, but usually one was run until it tripped off the line, only then was the started. Actually the biggest drawback of the class was in the minds of those who ran the Submarine Force at the time. For them the K Class submarine was that it was just too slow.

One must realize that the senior submariners at that time had all served on Fleet Boats in World War II. A Fleet Boat could make 21 knots on the surface, could *end around* most convoys, and could get to a firing position in a hurry. Although *Jane's Fighting Ships* said BONITA and the rest of its class could make 13 knots on the surface that proved to be some designer's dream. The best SOA (speed of advance) that could be counted on was about 6 knots, maybe 6.5 kts, but in rough seas much less. In fact, whenever transiting any distance which required a *movement report*, not unlike an aircraft flight plan by which a boats planned position could be calculated within a few miles, the entire class would almost always have to make several movement report changes in transit due to the sea state or engine repairs. Now 6 kts, plus or minus a little doesn't sound so bad for a sailboat, but COMSUBPAC, then Rear Admiral *Jumpin' Joe* Grenfell, a fiery, multiple Navy Cross winner from World War II, felt this was completely unsatisfactory.

Admiral Grenfell decided the class needed to put up or shut up. As a test of operational endurance he sent first BASS and then BONITA on an extended arctic patrol. BONITA had to stop off at Adak both going and returning to take on both fresh water and lube oil, this despite carrying multiple extra 5 gallon cans of lube oil in the sail. In addition the forward escape trunk was filled with fresh water. This was the source of fresh water for showers and washing. On station it was extremely cold and the snorkel mast would ice up while snorkeling, drawing a vacuum in the boat and periodically shutting the engine down due to the high vacuum cutout. But the worst problem during the patrol was self-generated.

The boat had a submerged collision with a massive iceberg that wiped off the radar antenna, damaged one periscope, and took away the VLF and HF antennas. Radio communications were maintained only through the long antenna wire (not very efficient). This collision happened when the conning officer saw what he thought were the lights of ships on the horizon, which by Captain's orders he was to close. Only to late discovering that what he had seen was the moonlight reflecting off ice. Upon return to Peal Harbor everyone onboard was proud to make it home in one piece, more or less, with no one hurt. Admiral Grenfell was livid. Just as soon as the Submarine Base and Pearl Harbor Naval Shipyard could affect repairs, he wanted us out of his sight. He was transferred both BASS and BONITA to San Diego.

So, when nine months later a submarine target was requested for Operation Hardtack, the 1958 atomic bomb tests at Eniwetok and Bikini, Admiral Grenfell who had already decided to decommission both submarines; decided why not volunteer BASS and BONITA.

Before going further let's examine the crew. For it is the crew that makes a Navy ship, certainly it makes a submarine, not the hardware. Overall the BONITA's wardroom officers were a tight knit group. When the chips were down they supported each other to the hilt with an overarching desire to carry out all tasks assigned. All submarine wardrooms are that way. The crew was good too, hard working, dedicated sailors who got along despite the close quarters and the many hours at sea. There was one *plank owner (*a member of the commissioning crew) still on board. He was an engineman named Gignac. Gignac was in the auxiliary gang and knew the boat cold. He was a great help to everyone trying to qualify in submarines. Certainly, a submarine crew at sea is very considerate of one another. For example, after use a washbasin or shower is never left without being wiping clean, leaving it in as good a condition for the next person. But submarine crews also engaged in pranks against one another like stealing the door to the Captain's Stateroom or hiding the seats to all the commodes.

The skipper was Bob Newbern, a dynamic, hard charging officer. Captain Newbern had been one of the instructors in Submarine School. He was in the Weapons Department there and was called Tubes *Newbs.* After BONITA he went on to a great command, as skipper of the submarine SALMON, where he distinguished himself winning more than one Battle Efficiency E. Far and above anyone else Captain Newbern was the reason it was possible to bring BONITA

back in one piece, rather than leave her on the bottom thousands of miles from home.

Before leaving for Eniwetok, BONITA had to be configured for the tests. This meant a three month availability at the old Hunter's Point Naval Shipyard, very close to where Candlestick Park is today on the south side of San Francisco Bay. First, four huge pad eyes were welded directly to the pressure hull protruding through the ballast tanks and seal welded to prevent escape of air from the tanks. These were to moor BONITA for the two blasts. Next, a means for venting and blowing ballast tanks from outside the pressure hull lad to be devised. This was accomplished by adding piping to the vent risers of two ballast tanks leading to two valves topside, and adding high pressure piping with a shut off valve from the topside high pressure air charging connection and the internal ballast tank blow piping. This latter valve was marked with bright white paint so that divers could see it. Finally strain gages were installed throughout the boat and several 1,000 frames per second movie cameras were installed to record what happens when the shock waves hit. An elaborate timing device was set up through a radio receiver to actuate the cameras at the exact time of the explosions. Since the atomic bomb tests meant that BONITA was less than likely to return from Eniwetok in serviceable condition, the boat was decommissioned at this time and placed in a new category called *In Service Special.* There was some debate whether it was still a *United States Ship,* but it was decided that it wasn't worth making that change. During this time the crew was also pared down to just those really needed for the transit out and to maintain all the equipment onboard.

During a battery charge the last night before leaving the shipyard, one of the *dinkies* blower mechanisms froze causing a brief fire. This in turn caused the engine to go hard down which required a blower replacement. Since the blower was bigger than our 25-inch diameter hatches, it meant a hole in the pressure hull had to be cut to remove the old blower and install the new one. Most skippers would have stayed in the shipyard to get this accomplished, but not Captain Newbern. He said, "We're leaving as scheduled. We'll get it fixed in San Diego."

Also in San Diego the Engineer Officer made a couple of modifications to BONITA that were to prove very effective for the transit to Eniwetok and return. First one of the auxiliary tanks was converted to a fresh water tank. All submarines have four tanks inside the pressure hull to trim the boat, that is make it neutrally buoyant when submerged, and not only just neutrally buoyant over all but stable both forward and aft. These four tanks are Forward Trim, near the bow; After Trim, near the stern; and two Auxiliary Tanks, as close to the center of buoyancy as possible. At Sub School young officers must learn how to dive a submarine and *trim it.* That means getting it neutrally buoyant after a dive. There are diving trainers to teach this that can be programmed to make the boat heavy or light, forward or aft. The diving officer has to figure this out in his head by the way the boat responds and pump or flood as necessary to get the ship into perfect trim. The diving officer has speed control of the boat until he makes his report: "Trim satisfactory, Sir." Only then does the conning officer take speed control. A favorite trick of conning officers is to order all stop after receiving a "trim satisfactory" report, particularly if his own evaluation of the trim indicates his diving officer was premature in reporting trim satisfactory. A submarine's Engineer Officer normally computes the trim before the first dive after any time in port taking into consideration all weight changes since the last trim dive, such as torpedoes, stores, fuel, etc. Anyway, since auxiliary tanks are quite large, this gave BONITA an ample supply of fresh water for the trip even if the distilling plants became less reliable.

The second thing converted was to modify a hydraulic oil tank to a lube oil tank. This solved the lube oil problem, but unfortunately created hydraulic oil problems. On the way to Pearl a number of hydraulic leaks developed that caused great concern. As a result of the excessive leaking only the hydraulically operated rudder vital to steer the boat was used. All other hydraulic equipment was isolated from the system. Captain Newbern even ordered to research what else could use on board for hydraulic fluid. The Engineer reported that Wesson Oil was the best substitute available. From then on the cooks didn't use any Wesson Oil until Pearl was reached. Upon departing Pearl fifty 5-gallon cans of hydraulic oil secured by white line everywhere in sail and superstructure.

While in Pearl Harbor Captain Newbern made a courtesy call on COMSUBPAC who told him in no uncertain terms not to bring BONITA back, that he didn't want to spend any more money on a piece of junk. And so with that send-off BONITA departed.

Arriving in Eniwetok was also quite an experience for a submarine used to operating alone. The Nuclear Test (Operation Hardtack) was a huge enterprise of which BONITA was truly a very small cog in a very large wheel. There

were 44 ships involved one way or another in the series of blasts. At first it was hard to find the right people to talk to. As someone said, there were 10,000 men in Bermuda shorts on a very small island, and no one seemed to be in charge. When BONITA finally was able to examine the plans for the first test it was soon concluded the chances of the boat surviving and not going to the bottom were minimal. The plan called for the weapon to be placed at 500 feet depth in 1000 fathoms of water. BONITA was to be submerged at a range of 4,000 yards, trimmed heavy and suspended from large floats. "Why don't we do the shallow water test first?" Captain Newbern asked. "That's not what the schedule calls for," was the reply. "Well, can the schedule be changed?" "No chance." Characteristically, Captain Newbern would not accept this answer. He had a wardroom meeting, and after much discussion he decided the only way for the boat to survive this first test was for BONITA'S crew to remain aboard. He then volunteered all of us except the XO, who was to remain in charge of crewmembers that stayed on the support ship USS HOOPER ISLAND. Captain Newbern ordered the officers to solicit one strong group of volunteers to be on board for the test. He then went to see the Chief of Staff to the Admiral in charge of the tests. When the skipper proposed the modifications for the deep-water test, he was told, "No, do it as planned." "Well, then," he replied, "I'd like to send this message." He pulled a typed message out of a folder addressed to the chain of command, including the Chief of Naval Operations, requesting that he be absolved of the loss of BONITA. The Chief of Staff blinked, told him to hold the message, and said he'd see what he could do.

Two days later the word came back that the boat would be manned. Since the range of 4,000 yards to the blast was too risky, it was move out to 6,000 yards for an extra safety factor. As the process of off-loading all consumables and classified publications to HOOPER ISLAND already had commenced, Captain Newbern didn't want any volunteers on board for the test to think there was any chance the boat wouldn't survive it, so he ordered them retrieved. He was right. Most of the volunteers were more than a little apprehensive.

Plans were devised as to how to rig the boat for survival. First off, BONITA was rigged for depth charge that meant all watertight doors were dogged shut and bulkhead flappers in the boat's ventilation system were closed. All seawater lines into the boat were secured during the countdown so that the over pressure would not cause any internal ruptures. This included all depth gage stops. This caused some amusement just before the test when Captain Newbern noticed that the boat was getting shallower and shallower (the depth gages were drifting after the stops were secured). He shouted at the diving officer with much colorful profanity. The diving officer quietly responded that the stops were shut, at which the skipper apologized. A simple tape recorder from the boat's allowance was rigged to record what was said in the Control Room and Conning Station. This was great fun listening to later, hearing voices rise in octave levels the closer the countdown came to the blast. When the blast occurred, a brief roar was heard on the tape, then nothing. The follow-on shock waves had blown the power cord out of its socket.

On the day of the first test, code-named WAHOO, the boat got underway early. Those on deck waving good by to the XO and about half of the enlisted crew who were to remain on the support ship. There was some kidding, but there was concern. A trim dive was made in deep water and BONITA took station at periscope depth and slow speed on a 6,000-yard radius circle from the blast point. The blast point was kept on the beam as the boat slowly circled. The nuclear device was suspended from an anchored barge. On the barge were antennas to receive the signal to detonate the device. The long countdown came over the radio to all in the area. There were at least three old destroyers and possibly other ships, unmanned that had been towed out to Eniwetok also in the circle at shorter ranges from the barge. The countdown was being relayed to all compartments from the Control Room over the General Announcing System. At 1330 on 16 May 1958 WAHOO blew. When the blast went off, it sounded to some like a freight train was running over the boat. The BONITA shook violently, light bulbs broke, dust and debris flew everywhere, and all the lights went out as the 75 KVA tripped off the line. It looked just as it does in a Hollywood movie. The on-watch engineman despite soiling himself ran as fast as he could to get the KVA back on the line.

Actually what hit the boat was three separate shock waves. The first one was the direct wave; the second, a bit milder, the bottom reflection; and the third, milder still, the surface reflection. Later the Engineer pointed out that if the direct shock wave and bottom reflection had arrived much closer together, there would have been serious trouble. After surfacing to return to HOOPER ISLAND further inspection found that both of escape trunks had water in them. This phenomenon was not understood until after the second test.

STERLET had problems also, which included a loss of power and a number of minor leaks. Film from the 1,000

frames per second cameras showed a ripple effect as the shock waves hit the steel hull, wrenching the hull and all the mounted equipment in the Control Room. The new sophisticated Fire Control System that provided all calculations to track a target and send torpedoes correctly on their way was damaged so badly that it could not be fixed. In combat BONITA would not have been able to continue to fight.

When BONITA arrived at Eniwetok, the place was not really geared for submarine crews. There was only one place enlisted man could go for liberty, a very small island called *Elmer* with a very small beach protected with a shark net. There was an open-air pavilion at which beverages were sold. Beer and any kind of a high ball went for 10 cents each, soft drinks were 15 cents each. There may have been some snack food too, but not much. Liberty policy for enlisted men was 10 percent of each crew was allowed on the island at any one time. This was due to number of ships present and the small size of the recreation area. Captain Newbern quickly got that changed for our crew, afterward BONITA could send up to half her crew to Elmer. The only way to get to the island was by Mike Boat, which picked up liberty parties about noon and returned them in the early evening. There was also Shore Patrol assigned to this so-called *recreation island*, three or four petty officers and one officer. One can readily imagine what happened in the hot afternoon sun with alcohol cheaper than soft drinks. Sailors on liberty got very drunk. One liberty party overpowered the Shore Patrol stripped them buck-naked and sent them back to their ships with no clothes at all. A few in our crew got in trouble after drinking too much, but for the most part behaved themselves. However there was one Second Class Engineman named Ashley who the skipper had to order not to drink at all, and he actually obeyed. The boat's saving grace was a volleyball tournament in which BONITA entered a team and won against several larger ships. This really perked up crew morale and kept it going for the next test.

The boat got underway for a rehearsal of the second test; code named UMBRELLA, early in the morning on the day before the test. This was the test the Submarine Force was most interested in, since a nuclear tipped torpedo was in the design stage. The Submarine Force needed to know how far the stand off range had to be so that the submarine that fired the torpedo didn't sink along with the target. The test took place inside the lagoon were the average depth of water was 100 feet. The boats position was bow on to the device at a range of 2950 feet. Chains with heavy weights attached were secured to our four pad eyes. The diving officer trimmed the boat some 10,000 pounds light so it would be at periscope depth with positive buoyancy. The outer door to one torpedo tube was opened to simulate the firing of a wire-guided torpedo. When all was ready the crew departed on a Fleet Tug. The Engineer and Captain Newbern were the last ones off. They opened the vent valves topside; it took BONITA 23 minutes to submerge. As this was a rehearsal run, and the divers in scuba gear went down and opened the painted white blow valve topside. The boat surfaced nicely, though with a slight down angle, with the diver riding up on deck and securing the blow and vent valves. Now all was ready for the actual test. The crew reboarded to recheck everything and spent the night while in the moored position.

The next day it was for real. This time all escape trunk hatches wired shut in an effort to keep them from lifting off their seats when the hull was deformed by the blast. It was hoped that no seawater would get in this time. The previous day's sequence was repeated. After evacuating the boat the crew waited out the test on the Fleet Tug. At 1115 on 9 June 1958 UMBRELLA went as scheduled. This time it was watched from about 10,000 yards away. It was quite a show. After BONITA was surfaced by the diver, almost everyone sighed with relief when she popped to the surface. BONITA was checked for radiation, and when the all-clear signal was given, the Fleet Tug returned the crew. The Engineer was first aboard, he unwired the escape trunk hatches, and proceeded below with a CO_2 sniffer to check each compartment. Again he found water had entered the boat through both escape trunks. It was later learned that for both blasts after the initial high-pressure shock wave there is also a very low pressure that follows. This low pressure lifted the hatches off their seats thus bringing in seawater. When the air in boat was determined to be was okay, the crew got back on board and got the boat ready to return to HOOPER ISLAND as soon as the chains with the weights could be removed from the pad eyes topside.

The next day there was another new problem. HOOPER ISLAND had taken radiation readings determining the submarine sailors from BONITA were all slightly radioactive. No one could come on board her without first being checked with a radiation detector and walking through a shoe washing solution. Again Captain Newbern got into the act and solved this dilemma rather quickly. Now the boat had to be made ready to return to San Diego. For over a week fire hoses were used to wash down the topsides and superstructure to eliminate the radioactive sand and coral that had logged in various nooks and crannies. When the boat surfaced following the blast the sand and water trapped in the superstructure had a reading of 2 roentgens. This level had to be reduced to 10 miliroentgens prior to our arrival in Pearl. A lot of hard work and scrubbing soon fix the problem.

A few days later after conducting a final trim dive, the last one for BONITA, and with permission from the Operation

Hardtack Commander, she was underway for Pearl. Just before leaving, the crew painted a new insignia on each side of the sail. It pictured an atomic bomb blast with two hash marks underneath it.

Upon arrival in Pearl and later in San Diego, it was a different story than before. The much-maligned BONITA was hailed even by COMSUBPAC. In the formal report of the two tests Captain Newbern recommended that never again should a submarine or, for that matter, a surface ship have to serve as a target for such tests. He had learned from some of the scientists on Eniwetok that the same kind of information could be obtained from shaped charges exploded at varying distances, which could be correlated to an atomic blast of any magnitude. Although I don't know whether surface ships ever adopted this, I do know that the Submarine Force adopted it, and no submarine ever went though any atomic tests after BONITA. As a footnote, the last atmospheric test at Eniwetok was conducted in 1962, Operation Dominic. After that all United States tests went underground on our own turf.